The glucose is distributed in a biological body and different measuring distances are used between the irradiation and detection sites in order to illuminate potential measurement errors caused by inhomogenities in the biological matrix. See column 16, lines 6-9 of the reference, for example. Accordingly, Simonsen does not disclose a device for measuring a concentration of metabolites in an organ and changes in the concentration at a location corresponding to a substantially midpoint position between a first light source and a light detector as a sampling point in combination with a second light source or light detector adapted to be disposed on the sampling point, as claimed by Applicants. Therefore, the reference does not anticipate or render obvious the invention set forth in pending claims 4, 5 and 8-10.

Conclusion

Upon reexamination, the application should be found to be in condition for allowance for the foregoing reasons. If any issues remain unresolved, the Examiner is requested to contact the undersigned attorney in order to resolve such issues.

Respectfully submitted,

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Date: April 29, 2004

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FORM PTO-1083

PATENT

Case Docket No. NIT-339

In RE application of T. YAMAMOTO et al

Serial No.: 10/148,991

Filed: September 9, 2002

For: BIOLOGICAL PHOTOMETRIC DEVICE

Group Art Unit: 3736

Examiner: M. Kremer

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Transmitted herewith is an Amendment in the above-identfied application.

☐ Small entity status of this application under 37 CFR 1.9 and 1.27 has been established by a verified statement previously submitted.

☐ A verified statement to establish small entity status under 37 CFR 1.9 and 1.27 is enclosed.

☒ No additional fee is required.

The fee has been calculated as shown below:

	(COL. 1) Claims Remaining After Amendment		(COL. 2) Highest No. Previously Paid For	(COL. 3) Present Extra	SMALL ENTITY Rate	SMALL ENTITY Additional Fee	OR	OTHER THAN A SMALL ENTITY Rate	OTHER THAN A SMALL ENTITY Additional Fee
Total	* 5	Minus	** 20	= 0	x 9	$		x 18	$ 0
Indep.	* 2	Minus	*** 3	= 0	x 42	$		x 84	$ 0
☐ First Presentation of Multiple Dependent Claims					+ 140	$		+ 280	$ 0
					Total	$	OR	Total	$ 0

* If the entry in Col. 1 is less than the entry in Col. 2, write '0' in Col. 3.
** If the 'Highest Number Previously Paid For' IN THIS SPACE is less than 20, write '20' in this space.
*** If the 'Highest Number Previously Paid For' IN THIS SPACE is less than 3, write '3' in this space.
The 'Highest Number Previously Paid For' (Total or Independent) is the highest number found from the equivalent box in Col. 1 of a prior Amendment or the number of claims originally filed.

☐ Please charge my Deposit Account No. 50-1417 in the amount of $__________.

☐ A check in the amount of $__________ is attached in payment of: __________.

☒ The Commissioner is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account No. 50-1417.

- ☒ Any filing fees under 37 CFR 1.16 for the presentation of extra claims.
- ☒ Any patent application processing fees under 37 CFR 1.17.
- ☒ Any Extension of Time fees that are necessary, which are hereby requested if necessary.

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Date: April 29, 2004

DETAILED DESCRIPTION OF THE INVENTION

The present invention is described herein in the context of an outboard engine. The present invention could, however, be utilized in connection with a stern drive engine as well as with an outboard engine. Further, the present invention is not limited to practice with any one particular engine, and therefore, the following description of an exemplary engine relates to only one exemplary implementation of the present invention.

Referring more particularly to the drawings, Figure 1 is a perspective view of an outboard engine 10, such as an outboard engine commercially available from Outboard Marine Corporation, Waukegan, Illinois. Engine 10 includes a cover 12 which houses a power head 14, an exhaust housing 16, and a lower unit 18. A drive shaft 20 extends from power head 14, through exhaust housing 16, and into lower unit 18.

Lower unit 18 includes a gear case 22 which supports a propeller shaft 24. One end of propeller shaft 24 is engaged to drive shaft 20, and a propeller 26 is engaged to an opposing end of shaft 24. Propeller 26 includes an outer hub 28 through which exhaust gas is discharged. Gear case 22 includes a bullet, or torpedo, 30 and a skeg 32 which depends vertically downwardly from torpedo 30.

Power head 14 includes an internal combustion engine having an exhaust system with an exhaust outlet. Power head 14 also includes an adapter 34. A port 36 is located in adapter and typically is used for emission testing of engine 10. A main exhaust gas duct extends through adapter 34 and exhaust housing 16 and into lower unit 18 so that exhaust flows from power head 14 through the gas duct and out hub 28.

Figure 2 is a schematic illustration of a probe and diaphragm assembly 50, sometimes referred to herein as an exhaust pressure sensing system, coupled to an engine ECU 52. System 50 includes a probe 54 coupled to a diaphragm assembly 56 by a first tube 58. Diaphragm assembly 56 is coupled to ECU 52 at an ECU port 60 by a second tube 62. Generally, and with respect to engine 10 shown in Figure 1, system 50 is located under cover 12 with probe 54 located within opening 36.

Alternatively, and rather than probe 54, diaphragm assembly 56 can be directly connected to the engine by one tube (e.g., tube 58) of sufficient length. In an

exemplary embodiment, tube 58 could be provided with a threaded member at the end to be secured to the power head. Of course, alternative connectors could be used to secure tube 58 to the engine. The probe therefore is not necessarily required for use with each type of engine, and assembly 56 can be utilized with and without a probe.

Figure 3 is a partial cross-sectional view of probe 54 installed in opening 36 of engine 10. A power head case 100 of engine 10 at opening 36 includes a water jacket 102 to cool case 100. Opening 36 is defined by a threaded wall 104. An exhaust duct, or path, 106 is formed by case 100, and path 106 extends from power head 14, through exhaust housing 16, and lower unit 18 (Figure 1).

Probe 54 includes an elongate probe body 110, and an engine engagement assembly 112 secured to probe body 110 and configured to engage to the engine so that probe body 110 at least partially extends into the engine exhaust path. Elongate probe body 110 includes a hollow, cylindrical shaped member 114 having at least one opening 116 through a side wall 118. More specifically, and in the embodiment shown in Figure 3, three openings 116 extend through cylindrical shaped member side wall 118. Openings 116 are radially spaced about 120° apart from each adjacent opening 116. Openings 116 are not axially aligned so that exhaust cannot simply flow into one opening 116 and then out another opening 116 without any interference by probe 54. Of course, more than or fewer than three openings 116 can be utilized. Elongate probe body 110 further includes a cap 120 secured to and closing an open end 122 of cylindrical shaped member 114.

Engine engagement assembly 112 includes a threaded portion 124 sized to be threadedly engaged within opening 36, and a tube connection portion 126 sized to be inserted within tube 58. Tube connection portion 126 includes a head 128 to prevent unintended separation of probe 54 and tube 58. Tube 58 is secured to tube connection portion 126 by a locking ring 130. Assembly 112 also includes a sealing portion 132 which when probe 54 is fully tightened into opening 36, tightly fits against case 100. A hex portion 134 also is provided to facilitate securing probe 54 within opening 36 using a wrench or other mating tool.

Figure 4 is a cross-sectional view of probe 54 along Line 4-4 in Figure 3. As shown in Figure 4, probe 54 includes a pellet 136 located within cylindrical shaped member 114. In an exemplary embodiment, pellet 136 is sintered metal. Cylindrical shaped member 114 includes an inner diameter surface 138, and a ledge 140 is formed by inner diameter surface 138. Pellet 136 is trapped between ledge 140

and cap 120 secured to and closing open end 122 of cylindrical shaped member 114. Pellet 136, in the exemplary embodiment, is at least coextensive with the location of openings 116 so that carbon and soot that may flow into probe 54 via openings 116 come into contact with pellet 136. A flow passage 142 extends longitudinally through probe 54 so that exhaust gas pressure is communicated through probe 54 and into tube 58.

Figure 5 is an exploded view of probe 154. As clearly shown in Figure 5, probe 154 includes elongate probe body 110, engine engagement assembly 112, and cap 120. Elongate body 110 is press fit into engagement with engine engagement assembly 112. Specifically, a bore 144 extends though threaded portion 124, and bore 144 is sized to form a tight fit with elongate body 110. Pellet 136 is inserted into body 110, and cap 120 is sized to be fit over pellet 136 and within body 110. Cap 120 forms a tight fit with body 110. Elongate body 110, engagement assembly 112, and cap 120 are fabricated, for example, from stainless steel. Pellet 136 is, for example, sintered metal.

To assembly probe 54 to power head 100, elongate body 110 is inserted through opening 36 and threaded portion 124 threadedly engages the threads of opening 36. A wrench or other tool can be used to tighted probe 54 so that seal portion 132 tightly fits against case 100. Tube 58 is then pushed over tube portion 126 and locking ring 130 securely maintains tube 58 in tight fit with portion 126. Probe tip 146 extends into exhaust duct 106 so that tip 146 is located within a hot portion of the exhaust flow during engine operation.

During engine operation, the exhaust gas emitted from each cylinder and is transmitted through and along exhaust duct or path 106. Some exhaust flows into probe 54 through openings 116, and the large particle of carbon and soot, which are naturally found in such exhaust are substantially blocked by sintered metal pellet 136 from flowing towards tube 58. That is, pellet 136 functions as a filter to prevent oil, soot, and carbon from entering and blocking passage 142. Since tip 144 is located in the hot portion of the exhaust flow, such heat is transferred to pellet 136 and to the blocked soot and carbon. The temperature within probe 54 at pellet 136 can reach a sufficiently high temperature so that the soot and carbon burn in probe 54.

Referring to Figures 6, 7, and 8, Figure 6 is a right side view of diaphragm assembly 56, Figure 7 is a left side view of assembly 56, and Figure 8 is a cross sectional view along Line 8-8 shown in Figure 7. Diaphragm assembly 56

includes a diaphragm housing 150 and a diaphragm 152 positioned in housing 150 and separating a first chamber 154 and a second chamber 156. First chamber 154 is configured to be in flow communication with the exhaust path and second chamber 156 is configured to be in flow communication with the engine control unit.

Diaphragm housing 150 includes a first housing member 158 and a second housing member 160. Housing members 158 and 160 are fabricated using, for example, plastic molding processes. First housing member 158 has an inlet 162, and second housing member 160 has an outlet 164. An inner surface 166 of first housing member 158 also is a side wall of first chamber 154, and inner surface 166 has a conical shape to facilitate drainage of water from first chamber 154. Also, first chamber 154 has a first volume and second chamber 156 has a second volume. The first volume is greater than the second volume.

Diaphragm 152 includes an o-ring 168 and a diaphragm member 170 integral with o-ring 168. O-ring 168 and diaphragm member 170 are fabricated, for example, from fluorosilicone. First and second housing members 158 and 160 each include an o-ring groove 172 and 174 so that when housing members 158 and 160 are assembled, diaphragm o-ring 168 is trapped between first and second housing members 158 and 160 in grooves 172 and 174. First and second housing members 158 and 160 are secured together by screws 176 which extend through openings in second housing member 160 and into threaded bosses 178 of first housing member 158.

Prior to operation of the engine, diaphragm assembly 56 is coupled to the engine so that first chamber 154 is in flow communication with the engine exhaust path and second chamber 156 is in flow communication with the engine control unit. In one embodiment, first tube 58 extends from inlet 162 to probe 54, and second tube 62 extends from outlet 164 to the engine ECU. Tubes 58 and 62 are secured to inlet 162 and outlet 164 by locking rings 180.

Tube 62 may include a flow restrictor 182 to dampen pressure spikes transmitted through tube 62 to the engine ECU, resulting in the final pressure reading at the ECU representing an averaged measure of the exhaust gas pressure. Restrictor 182 may, for example, be fabricated from brass and include a reduced size flow section 184 having a through hole with a diameter of about 20/1000 of an inch.

The air in second chamber 156 and tube 62 is trapped. That is, second chamber 156 and tube 62 are sealed so that air does not escape therefrom. Limiting the volume of trapped air is beneficial in that as such trapped air is heated and expands, such expanding air acts on diaphragm 152. It would be undesirable for diaphragm 152 to fully expand due to expansion of the trapped air since if diaphragm 152 fully expands into first chamber 154, it will no longer communicate an accurate pressure change from the first chamber 154 to second chamber 156. By limiting the volume of trapped air, the extent of the expansion of diaphragm 152 also is limited so that even on extremely hot days, diaphragm 152 still efficiently transmits exhaust pulses from first chamber 154 to second chamber 156.

During engine operation, changes in exhaust gas pressure are communicated to diaphragm 152 via first tube 58. The change in exhaust pressure causes diaphragm 152 to compress air in second chamber 154 and in second tube 62. As a result, the pressure change is transmitted through second chamber 154, second tube 62, and to the engine control unit. The engine control unit can use such exhaust gas pressure data to control engine operations, such as to control the fuel / air ratio in the engine cylinders.

The above described diaphragm facilitates communication of engine exhaust pressure information to an engine control unit and protects the control unit from direct exposure to the exhaust flow.

The above described diaphragm assembly 56 could be sold in kit form. In an exemplary embodiment, the kit includes diaphragm assembly 56, and a tube for connecting the diaphragm to the engine exhaust duct (e.g., directly or via a probe) and to an engine ECU. Of course, locking rings also may be included in the kit for securing the tube to the tube connector portions of the various components. The kit may also include a probe for being at least partially inserted within the exhaust flow.

While the invention has been described in terms of various specific embodiments, those skilled in the art will recognize that the invention can be practiced with modification within the spirit and scope of the claims.